Mountain View Jr/Sr High School

AP Chemistry Course Syllabus

NAME OF COURSE: AP Chemistry

GRADE(S): 10-12

LENGTH OF COURSE: full year

COURSE DESCRIPTION:

AP Chemistry is designed to be the equivalent of a first year college general chemistry course. The class meets five times a week during a double period to ensure more hands on lab experiences.

The course will place special emphasis on applying mathematics to problem solving and as a means of expressing and modeling scientific inquiry. The course will provide an in depth treatment of atomic structure, gas laws, thermochemistry, stoichiometry, kinetics, equilibria, oxidation-reduction and electrochemistry.

Since the course will be rigorous I encourage you to stay on top of the reading and ask questions before falling behind. You will need to be prepared to put more work into this class than any other class you have taken. Remember your goal is to pass the AP exam and in doing so it will take a lot of perseverance and hard work.

COURSE OBJECTIVES:

* Develop students’ problem solving skills
* Provide laboratory experience that enables students to analyze collected data and arrive at logical conclusions
* Provide inquiry based instruction to help students become life-long learners and increase cognitive abilities
* Give students the background necessary to score well on the AP exam
* Prepare students for additional courses in science
* Develop students’ ability for independent and logical thought
* Increase students’ ability to apply math to physical sciences

TEXTBOOK:

Nivaldo, Tro J. Chemistry: A Molecular Approach AP Edition Pearson Education

SUPPLEMENTARY INSTRUCTIONAL MATERIAL:

* Online access to the textbook.
  + Workshops
  + Homework problems
  + Tutorials
  + Etc.

OTHER COURSE MATERIALS:

Material Type:Other

Description:Review Books:

Cracking the AP Chemistry Exam

Princeton Press, NY

Material Type:Other

Description:How to Prepare For The AP Chemistry Exam

Jespersen

Barrons Press, NY

WEBSITES:

URL:http://apcentral.collegeboard.com/apc

Description:The college board AP Chemistry site

URL:http://dbhs.wvusd.k12.ca.us/webdocs/chemTutorIndex

Description:problems and tutorials for all segments of AP Chemistry

URL:http://lrc-srvr.mps.ohio-state.edu/under/chemed/qb

Description:A resource that includes all topics for the course with tutorials and quizzes

UNITS OF STUDY:

Unit Name or Timeframe:

1. Introduction: Matter, Measurement and Problem Solving (Chapters 1-4)

1-2 weeks depending on students’ assessed level of need to reinforce basic skills

Content and/or skills taught:

* chemical investigation methods
* significant figures
* accuracy and precision
* dimensional analysis
* gravimetric problem solving
* data analysis
* variable relationships with graphing

Essential Skills:

* describe and explain basic investigative methods in chemistry
* analyze experimental results and arrive at a logical conclusions
* work comfortably with metric units and solve problems in dimensional analysis
* use proper significant figures in data analysis
* solve gravimetric problems

Major Assignments and/or Assessments:

* Lab Report: Accuracy and Precision
* Lab Report: Indentify and Unknown Substance
* Optional Labs: Paper Chromatography and Fractional Crystallization
* Homework Assignments: Teacher selected from Chapter 1 in the textbook
* Case Study or Recent Article Summary
* Teacher created Unit 1 Test

Unit Name or Timeframe:

1. Atomic Theory: 1.5 weeks (Chapter 2)

Content and/or Skills Taught:

* Development of atomic theory: Dalton, Thomson, Millikan, Geiger, Mardsen, and Rutherford
* Chemical Formulas
* Mass percent
* Empirical and molecular formulas
* Isotopes
* Inorganic nomenclature: introduction to organic functional groups

Essential Skills:

* Describe and explain the importance of the experiments that led to our modern understanding of the atom
* Describe electrons, protons, neutrons, and the general structure of the atom
* Explain the concepts of atomic number, atomic mass, and isotopes
* Calculate and differentiate between empirical and molecular formulas
* List the charges associated with common polyatomic ions
* Use the terminology of the periodic table- groups, periods, metal, nonmental, metalloids etc.

Major Assignments and/or Assessments:

* Lab Report: Determination of the Chemical Formula and percent of water in a hydrate
* Poster/Presentation on selected part of the Periodic Table
* Homework: Teacher Selected Homework Problems from Chapter 2
* Teacher created unit 2 test

Unit Name or Timeframe

1. Chemical Reactions-3.5 weeks (Chapter 3 and 4)

Content and/or Skills Taught:

* Mole and quantity calculations
* Equation balancing and explanation of information included in the chemical equation
* Stoichiometric calculations method
* Information on limiting reagents and theoretical yields
* Solutions

Essential skills:

* Work problems involving moles
* Work problems involving solutions
* Explain the nature of ions in solutions
* Define and use molarity in solution chemistry
* Balance equations
* Solve stoichiometric problems involving percent yield and limiting reagents
* Write chemical equations for the general type of reactions including synthesis, decompositions, single replacement, double replacement, and combustion, as weel as the specific types of oxidation-reductions and acid-base reactions
* Identify by inspection the category a reaction belongs in
* Use stoichiometry to analyze a mixture of compounds or to determine the formula for a compound

Major Assessments and/or Assignments:

* Lab Report: Gravimetric Analysis
* Lab Report: Solubility analysis
* Optional Lab Report: Synthesis of Alum and Job’s Method for Stoichiometry
* Homework: Teacher selected problems from text (ch 3 and 4)
* Teacher created unit 3 test

Unit Name and Timeframe:

1. States of Matter. 4 weeks (Chapter 5 and 11)

Content or Skills Taught:

* Gas laws including van der Waals equation
* Application of the gas laws to stoichiometric problems
* Kinetic molecular theory and distribution of molecular speeds
* Properties of liquids and solids with more focus on liquids
* How to generate and read a phase diagram and the Clausius-Clapeyron equation will be used since it connects temperature, vapor pressure, and enthalpy of vaporization

Essential Skills:

* Describe the general characteristics of states of matter
* Work gas law problems
* State and understand kinetic molecular theory
* Apply kinetic molecular theory to liquids and solids as well as gases
* Draw and understand phase diagrams
* Work problems involving molarity, molality, mole fraction, and normality
* Explain and be able to calculate colligative effects
* Explain the can der Waals corrections for a non-ideal gas
* Explain the factors affecting vapor pressure
* Be able to work Henry’s Law problems
* Work problems with Raoult’s Lab
* Work problems using the Clausius-Clapeyron equation

Major Assignments and/or Assessments:

* Teacher created Unit 8 Test (could be split into two tests \*Gases and then solids and liquids)
* Lab Report: Boyle’s Law
* Lab Report: Molar Mass of a Volatile Liquid
* Lab Report: Vapor Pressure and Heat of Vaporization of a Liquid
* Lab Report: Molecular Weight by Freezing Point Depression
* Homework: Teacher Selects questions from the chapter 5 and 11
* Various Quizzes
* \*\* Might split into two units (Chapter 5 and Chapter 11)

Unit Name or Timeframe:

1. Kinetics. 2.5 weeks (Chapter 13)

Content and/or Skills Taught:

* How to find rates of reactions from experimental data followed by how conditions affect those rates
* Methods for determining the rate equation with emphasis on -1, 0, 1st, and 2nd order equations
* Introduce some calculus and graphing
* Many rate problem examples
* Arrhenius equation and its uses
* Reaction mechanisms

Essential Skills:

* Explain rates of reaction and the conditions affecting rates
* Be able to derive average and instantaneous rates from experimental data
* Derive the equation, rate constant, and reaction order from the experimental data
* Use integrated rate laws
* Understand the collision theory and activation energy
* Use the Arrhenius equations
* Be able to relate reaction mechanisms to rate laws
* Understand and be able to draw reaction coordination diagrams
* Understand the function of a catalyst and the effect on the reaction mechanism and activation energy

Major Assignments and/or Assessments:

* Teacher Creates Unit 9 Test
* Lab Report: Rate and Order of Reaction (yeast one? With purple and clear reaction)
* Optional: Lab Report, The Iodination of Acetone
* Homework: teacher selected questions from chapter 13
* Various quizzes
* Project?

Unit Name or Timeframe:

1. Equilibrium. 2.5 weeks (chapter 14 and 16)

Content and/or Skills Taught:

* Dynamic equilibrium including Le Chatelier’s Principles
* Meaning of the equilibrium constant and the reaction quotient are introduced and methods for solving equilibrium systems problems
* Thermodynamics will be reintroduced to understand the relationship between Gibb’s Free Energy and K

Essential Skills:

* Explain the nature and characteristics of chemical equilibria
* Explain the reaction quotient Q and the equilibrium expression
* Recognize the states that belong in the equilibrium expression
* Realize the different ways we can express equilibrium quantities
* Use reaction quotient to decide how a reaction will or will not proceed
* Calculate the equilibrium constant
* List and explain the factors that influence K
* Explain how to use Le Chatelier’s Principle to predict the effect of disturbance of an equilibrium system
* Show how the Gibb’s Free Energy relates to the equilibrium constant
* Distinguish the various forms of K (sp, a, b)
* Work problems involving Ksp

Major Assignments and/or Assessments:

* Teacher Created Unit 10 Test
* Lab Report: Determination of the Equilibrium Constant
* Lab Report: Ksp Ca(OH)2
* Homework: Teacher selected problems from ch 14 and 16
* Various quizzes
* Projects
* Reading critiques

Unit Name or Timeframe:

1. Acids and Bases. 2.5 weeks (chapter 15)

Content and/or Skills Taught:

* Arrhenius, Bronsted-Lowry, and Lewis acid base theories
* Concepts of Ka and Kb will be tied into the previous unit and the students will realize that the problems are identical in format
* Titrations will be introduced and a number of problems should be presented
* Buffer preparation and buffer calculations will be done using the Henderson-Hasselbalch equation

Essential Skills:

* State and distinguish the 3 acid-base definitions Arrhenius, Lewis, and Bronsted-Lowry
* Correctly use the terminology amphiprotic and autoionization
* Identify common strong acids and bases
* Understand the pH and pOH scales and solve problems with them
* Write equilibrium expressions for weak acids and bases
* Solve acid-base equilibrium problems
* Calculate pKa and pKb
* Predict the outcome of acid-base reactions
* Use the Henderson-Hasselbalch equation
* Show how to prepare a buffer solution
* Find pH at equivalence point of a titration
* Describe the function of an indicator

Major Assignments and/or Assessments:

* Teacher created unit 12 test
* Lab Report: titration of a diprotic acid
* Lab Report: Identification of a solid organic acid
* Optional Lab: k value of an indicator
* Optional Lab: Preparation of a Buffer
* Homework: teacher selected problems from chapter 15
* Quizzes
* Critique or article or published work
* Project?

Unit Name or Timeframe:

1. Energy in Chemical Reactions. 2 weeks (chapter 6: Thermochemistry)

Content and/or Skills Taught:

* Three laws of thermodynamics and their implications
* Conservation of energy, temperature and heat will be introduced
* Specific heat capacity theory and problems will be done and applied to first law problem solutions
* Enthalpy and entropy changes
* Hess’s Law and the terms heat of reaction and heat of formation

Essential Skills:

* Define the various forms of energy and the nature of heat flow
* Use and explain the terms enthalpy, entropy, heat of reaction, heat of formation, calorimetry, joule, calorie, BTU, system, and surroundings
* Solve calorimetry problems
* Apply and understand the zeroth, first, and second laws of thermodynamics
* Define and understand the state functions enthalpy and internal energy
* Apply Hess’s Law
* Show how to draw and interpret energy diagrams

Major Assignments and/or Assessments:

* Lab Report: Caloimetry
* Lab Report: Hess’s Law
* Thermodynamics now article?
* Teacher created unit 4 test

Unit Name or Timeframe:

1. Chemical Thermodynamics. 1.5 weeks (ch 17)

Content and/or Skills Taught:

* Laws of thermodynamics
* Relationship between spontaneity and direction in a chemical process
* Entropy as a state function
* Spontaneity in the reverse direction or in equilibrium
* Relationship between changes in Gibbs free energy and the equilibrium constant

Essential Skills:

* Calculate changes in entropy
* Identify whether processes are spontaneous as described
* Define Gibbs free energy and calculate changes in free energy for given processes
* Determine the effect of temperature on spontaneity
* Describe the relationship between changes in free energy and the equilibrium constant

Major Assignments and/or Assessments:

* Teacher created Unit 11 Test
* Lab Report: Entropy and Microstates
* Homework: teacher selected questions from chapter 17
* Quizzes
* Projects
* Writing critique on printed article or published work

Unit Name and Timeframe

1. Oxidation, Reduction and Electrochemistry. 2 weeks (ch 4 and 18)

Content and/or Skills Taught:

* Review of balancing redox reactions
* Principles underlying voltaic cells will be introduced along with the half-cells and potentials
* Relationship between voltage and concentrations and problems involving NERST equation
* Concept of electrolysis and revisiting Gibb’s Free Energy as it relates to cell voltage

Essential Skills:

* Balance redox reactions
* Construct and diagram voltaic cells
* Understand and calculate electrochemical potentials
* Use the Nernst equation to solve problems
* Explain the relationship between voltage and Gibb’s Free Energy

Major Assignments and/or Assessments:

* Teacher created Unit 13 Test
* Lab Report: Electrochemistry
* Optional: Determination of Iron by reaction with permanganate
* Optional: Equivalent mass by electrolysis
* Homework: Teacher selected problems from chapters 4 and 18
* Quizzes
* Critiques on article or published work
* Lab notebook
* Projects or guest speaker questions

Unit name and Timeframe:

1. Atomic Structure. 2 weeks (chapter 7)

Content and/or Skills Taught:

* Description of wave behavior and an emphasis on electromagnetic waves
* Work of Einstein, de Broglie, Bohr, Heisenberg, Planck, and Schrodinger will be discussed in detail
* Atomic spectra and reference to the Balmer, Paschen, Brackett, and Pfund series
* Quantum numbers and their application to writing electron configurations

Essential Skills:

* Use and understand the terms frequency, wavelength, amplitude, and node. Be able to solve problems of the form velocity= frequency x wavelength
* Solve problems using Planck’s relationship between energy and frequency
* Describe the Bohr model of the atom
* Explain and use quantum numbers
* Explain and solve equations using the Heisenberg Uncertainty Principle
* Work problems involving electron energy transitions
* Explain the Pauli exclusion principle and Hund’s rule
* Write electron configurations

Major Assignments and/or Assessments:

* Lab Report: Atomic Spectra of Hydrogen
* Homework Assignments: Teacher selected from text Chapter 7
* Group work project or atomic spectra Lab
* Teacher created unit 5 test

Unit Name or Timeframe:

1. Electron Configurations and Chemical Periodicity. 1.5 weeks (Chapter 8)

Content and/or Skills Taught:

* History of the development of the modern periodic table
* Concept of electron spin and magnetic effects
* Periodic trends will be addressed in detail including graphs showing periodic tendencies
* Ideas of shielding and effective nuclear charge

Essential Skills:

* Understand the basis for the periodic law and apply it to the periodic properties such as atomic radii, ionization energy, electron affinity, density, melting point, and oxidation states
* Understand electron spin and how magnetism influences atom properties
* Understand the concept of effective nuclear charge

Major Assignments and/or Assessments:

* Lab Report: Periodic Behavior
* Group work: Periodic Properties Lab
* Homework Assignments: Teacher Selected from chapter 8
* Teacher created unit 6 test

Unit Name and Timeframe:

1. Chemical Bonding. 2 weeks (chapter 9 and 10)

Content and/or Skills Taught:

* Ionic Bonding calculation and covalent bonding
* Lewis structures
* Bond polarities and their effect on molecular behavior
* VSPER theory and the molecules shapes driven by it
* Hybrid orbitals and molecular orbital theory

Essential Skills:

* Explain what constitutes ionic and covalent bonds
* Explain the intermolecular forces and the reasons they exist
* Explain how polarity arises in a molecule
* Be able to do Lewis dot structures for molecules
* Apply VSPER
* Explain the meaning of hybrid orbitals and the molecules that contain them
* Explain molecular orbital theory
* Be able to predict the geometric shape of molecules

Major Assignments and/or Assessments:

* Lab Report: Molecular Models
* Lab Report: Classification of Substances by Type of Bonding
* Homework Assignments: Teacher Selected from text chapter 9 and 10
* Teacher created unit 7 test

Unit Name or Timeframe:

14.) AP Exam Review. 2-3 weeks.

Content and/or Skills Taught:

* Help students prepare for the approaching AP Chemistry Exam
* Strategies on test taking
* Concentrated work and review of previous AP questions
* Practice AP questions from the AP central web site for the free response section of the exam
* Practice multiple choice and free response questions from review books in the resources section
* Solve a number of AP style problems
* Score a 3 or higher on the practice AP exams

Major Assignments and/or Assessments:

* Practice AP exams from review books and AP Central web site
* Final exam
* Actual AP Exam scores

PROFICIENCIES:

See above by unit under ESSENTIAL SKILLS

FIELD TRIPS & GUEST SPEAKERS:

As appropriate

EVALUATION AND ASSESSMENT:

A point based system from various types of assignments, quizzes, tests, lab reports, writing assignments, research assignments, etc.